REMARKS

The rejections:

under 35 U.S.C. § 102(b) of Claims 2, 4, 6-9, 11-13, 15-18 and 23-30 as anticipated by U.S. 6,045,896 (Boire et al), and

under 35 U.S.C. § 103(a) of:

Claims 7-8 and 28-29 as unpatentable over Boire et al in view of U.S. 5,723,075 (Hayasaka et al);

Claim 14 as unpatentable over Boire et al in view of U.S. 5,595,825 (Guiselin); and

Claim 22 as unpatentable over Boire et al in view of U.S. 4,565,719 (Phillips et al),

are respectfully traversed.

The present invention relates to a laminate having titanium oxide layers and its production method.

As described in the specification under "Background Art," beginning at page 1, line 6, laminates having metal layers laminated on a transparent substrate such as glass have been widely used for window glass in buildings and automobiles, for example, for purposes of suppressing emission of heat rays and as a shielding material to suppress leakage of electromagnetic waves radiating from an apparatus such as a plasma display. At the same time, a high visible light transmittance and a low visible light reflectance is required, as well as a preferred reflection color tone. For this purpose, it is well known to use a laminate having a layer construction wherein dielectric material layers and metal layers are alternately laminated one on another. A low heat ray emissivity alone can be obtained by making the metal layer thick, but this may cause a decrease in the visible light transmittance and increase in the visible light reflectance, and the wavelength range in which a low reflectance can be obtained in the visible light region tends to be narrow, whereby a preferred reflection color

tone may be impaired. The above unfavorable phenomenon that the reflection color tone is impaired can be somewhat diminished by using a high refractive index material such as titanium oxide as the dielectric material layer, or by increasing the number of laminations. However, when using such a laminate with titanium oxide layers, visible light transmittance tends to decrease, and further, the rate of decrease in the visible light transmittance tends to increase together with the increase in the number of laminations. The present invention addresses these problems.

As recited in above-amended Claim 11, the present invention is a laminate which comprises a substrate, and a titanium oxide layer, a metal layer and a titanium oxide layer laminated alternately in this order on the substrate in (2n +1) layers (wherein n is a positive integer), wherein an interlayer having a refractive index of less than 2.4 at a wavelength of 550 nm is interposed at at least two interlaminar boundaries between the titanium oxide layer and the metal layer, wherein each interlayer independently is a layer consisting of at least one member selected from the group consisting of a nitride, an oxynitride, a carbide, a boride, niobium oxide, GZO, and ITO, and wherein each metal layer independently is a layer containing silver as the sole or main component, and which laminate contains at least two metal layers.

The present invention seeks to maximize visible ray transmittance. For this, the interface between the titanium oxide layer and the metal layer has significance. As described in the paragraph in the specification bridging pages 8 and 9:

> In a constitution wherein titanium oxide layers and metal layers are alternately laminated, when the number of lamination is increased, the wavelength width in which a low reflectance can be obtained in the visible light region will increase. However, it was confirmed that the tendency of decrease in transmittance becomes significant along with increase in the number of lamination, more than expected from optical interference effect. The present inventors have conducted extensive studies on this phenomenon and as a result, found that the decrease in transmittance occurs at the interface between the titanium oxide layer and the metal layer. This phenomenon is estimated to be light absorption due to surface plasmon excited by light irradiation in the inside of the metal layer, particularly in the vicinity of the interface with the

> titanium oxide layer, and it is considered that formation of the surface plasmon can be suppressed to reduce the decrease in transmittance by interposing a layer having a refractive index lower than that of the titanium oxide as an interlayer.

Accordingly, it is unnecessary to increase the thickness of the interlayer to be more than required based on cost considerations. Further, by setting the thickness of the interlayer as described above, the reflectance can be lowered, whereby a wavelength range for obtaining low reflectance can be widened.

In addition, Examples 1-131 and Comparative Examples 1-16 in the specification support the patentability of the presently-claimed invention.

Boire et al is drawn to addressing a problem resulting from heat treating so-called silver-type low-emissivity or solar-protection glazing assemblies, which heat treating causes various optical defects, as disclosed generally at columns 1 and 2. Particularly, Boire et al is drawn to a glazing assembly comprising at least one transparent substrate provided with a stack of thin layers which includes an alternation of n functional layer(s) having reflection properties in the infrared and/or in solar radiation, in particular of an essentially metallic nature, and of (n+1) "coatings", with n $\geq$1, wherein the "coatings" are composed of a layer or a plurality of layers, at least one of which is made of a dielectric material, and the functional layers and the coatings are arranged so that the (each) functional layer is placed between two coatings (paragraph bridging columns 2 and 3). Boire et al further discloses (column 3, lines 8-23):

> With a view to preserving the optical quality of the stack in the case where the substrate once provided with the stack is subjected to a heat treatment of the toughening, bending, annealing type:
>
> on the one hand, the coating placed on top of the functional layer, or on top of one of the functional layers, and in the latter case preferably the nth layer, includes at least one "barrier" layer made of a material capable of forming a barrier at least to oxygen and water; and
>
> on the other hand, at least one "absorbent" or "stabilizing" layer made of a material capable of "absorbing" or "stabilizing" the constituent material of the said functional layer forms part of:

either the coating placed on top of the functional layer and under the "barrier" layer;
or the coating placed under the said functional layer.

Boire et al discloses that in addition to providing the barrier layer on top of the functional layer, it may also be placed under the functional layer when the barrier layer is made of a material capable of preventing the migration of oxygen and water from the ambient atmosphere into the functional layer (column 4, lines 1-15); that the functional layers are made of silver or a metal alloy containing silver (column 5, lines 16-19), although no such metal alloys are exemplified; that their invention applies not only to a single functional layer placed between two coatings, but also to a plurality of functional layers, in particular two functional layers alternating with three coatings, or three functional layers alternating with four coatings (paragraph bridging columns 4 and 5). Boire et al lists various exemplary materials for their barrier layer and absorbent or stabilizing layers, respectively. With regard to the disclosure of a titanium oxide therein, it is listed among various oxides which may be present as a porous layer, having a porosity of at least 2% and acting as an absorbent layer (column 5, line 59 through column 6, line 20), or as a layer that surmounts the barrier layer or at least one of the barrier layers (column 7, lines 19-25). These are the only disclosures of a titanium oxide in Boire et al.

All embodiments of the present invention require at least three titanium oxide layers, one of said titanium oxide layers being laminated on the substrate; Claim 13 requires at least four titanium oxide layers.

As stated in *In re Arkley*, 172 USPQ 524, 526 (CCPA 1972) **(copy enclosed)**:

> [R]ejections under 35 U.S.C. 102 are proper only when the claimed subject matter *is* identically disclosed or described in "the prior art." Thus, for the instant rejection under 35 U.S.C. 102(e) to have been proper, the . . . reference must clearly and unequivocally disclose the claimed [subject matter] or direct those skilled in the art to the [subject matter] without *any* need for picking, choosing, and combining various disclosures not directly related to each other by the teachings of the cited reference. Such picking and choosing may be entirely proper in the making of a 103,

> obviousness rejection, where the applicant must be afforded an opportunity to rebut with objective evidence any inference of obviousness which may arise from the *similarity* of the subject matter which he claims to the prior art, but it has no place in the making of a 102, anticipation rejection.

Boire et al does not meet the *Arkley* test. At the very least, picking, choosing and combining various disclosures not directly related to each other would be required in order to meet the terms of the present claims. In addition, and as now discussed, even such picking and choosing would not result in any of the presently-claimed inventions.

It is not seen how one skilled in the art would derive from Boire et al a laminate wherein a titanium oxide layer is laminated on the substrate therein, regardless of whether titanium oxide is chosen as a porous absorbent layer therein, or as a dielectric layer surmounting a barrier layer. Moreover, even if Boire et al's disclosure could be stretched to include such an embodiment, the number of possible combinations of layers, resulting from the many alternatives disclosed by Boire et al, runs into the thousands. In addition, none of the examples in Boire et al use a titanium oxide layer. Thus, under the rationale of *In re Baird*, 29 USPQ 2d 1550 (Fed. Cir. 1994) **(copy enclosed)**, no *prima facie* case of obviousness has been made out..

The Examiner relies on Figure 1 of Boire et al, but incorrectly characterizes it. For example, the Examiner characterizes Figure 1 as "a dielectric oxide layer (2a)," and finds that layer (2a) can be titanium oxide, thus broadening Boire et al's disclosure of layer (2a) to be inclusive of any dielectric oxide. In all of Boire et al's examples, layer (2a) is made of tin oxide. However, the only disclosure in Boire et al wherein tin oxide and titanium oxide are interchangeable, is with regard to a layer of dielectric material that surmounts the barrier layer or at least one of the barrier layers (column 7, lines 19-25). Since layer (2a) is the first layer on the substrate, it is clear that layer (2a) is not intended to be the layer of dielectric material that surmounts the barrier layer or at least one of the barrier layers. In other words, the tin oxide performs another function, such as absorbent layer material according to a

second embodiment (column 6, line 37). Based on the disclosure at column 8, lines 9-12, it appears that the tin oxide of layer 2a is intended to play the same role as Si_3N_4.

In addition, and contrary to the finding by the Examiner, there is no first barrier layer comprising silicon nitride between layers (2a) and (2b) in Figure 1. As described beginning at column 9, line 39, layer (2a) is made of SnO_2 and layer (2b) is made of ZnO. Neither of these layers constitute a barrier layer, based on the disclosure that the barrier layer has a refractive index between 1.7 and 2.5, and is in particular based on a silicon compound or a carbide (column 5, lines 20-37).

In sum, the Examiner has relied on disparate disclosures in Boire et al in order to come up with a modified structure for Figure 1 of Boire et al that is simply not supported by Boire et al.

Regarding Claims 7-8, Hayasaka et al discloses heat wave shielding materials comprising dimerized thiourea derivatives as near-infrared absorbents (column 14, lines 21-35). However, that such materials are known in the art does not in and of itself provide the requisite motivation to provide such a film on the glazing assembly of Boire et al. Without the present disclosure as a guide, one skilled in the art would not have combined Boire et al and Hayasaka et al.

Regarding Claim 14, while the Examiner relies on Guiselin's disclosure that increasing the number of metal film layers in a stack enables the solar protection to be optimized, Guiselin also discloses that increased metal film layers leads to a reduction in transparency of the pane, which manifests itself in a decrease in the value of the light transmission T_L of the pane (column 1, lines 30-32). In addition, the invention of Guiselin includes only three layers having infrared reflection properties, i.e., three metal, such as silver, layers.. Indeed, Guiselin actually teaches away from the addition of further metal layers.

Regarding Claim 22, while Phillips et al discloses a metal layer of either silver or a silver-palladium alloy in an energy control sheet, the Examiner has not established that the degradation upon heat treatment addressed in Boire et al would manifest itself when the functional layer is a silver-palladium alloy. Without such a disclosure, one skilled in the art would not have employed a silver-palladium alloy as the functional layer(s) of Boire et al.

For all the above reasons, it is respectfully requested that the rejections over prior art be withdrawn.

The rejection of Claims 17-21 under 35 U.S.C. § 112 as indefinite with regard to "x" in the formulae SiN_x and NbO_x, is respectfully traversed. Such nomenclature is well-known in the glazing art, and indeed, is supported by Boire et al, *supra*. Such nomenclature is used when non-stoichiometric variants are to be included in a particular genus of compounds. See, for example, Claim 1 of Boire et al. There was no limitation on the value of "x" intended herein so long as a compound containing a given value of "x" is within the definition of the interlayer. Nevertheless, the rejection is moot in view of the above-discussed amendment. Accordingly, it is respectfully requested that it be withdrawn.

All of the presently pending and active claims in this application are now believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully

requested to examine all claimed subject matter and, in the absence of further grounds of rejection, pass this application to issue with all pending claims.

Respectfully submitted,

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